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(71) Applicant and
(72) Inventor: NAGLE, Michael, G. [US/US]; 2817 McClelland Boulevard #254, Joplin, MO 64804 (US).

(74) Agents: LYMAN, Beverly, A. et al.; Wood, Herron & Evans, L.L.P., 2700 Carew Tower, Cincinnati, OH 45202 (US).

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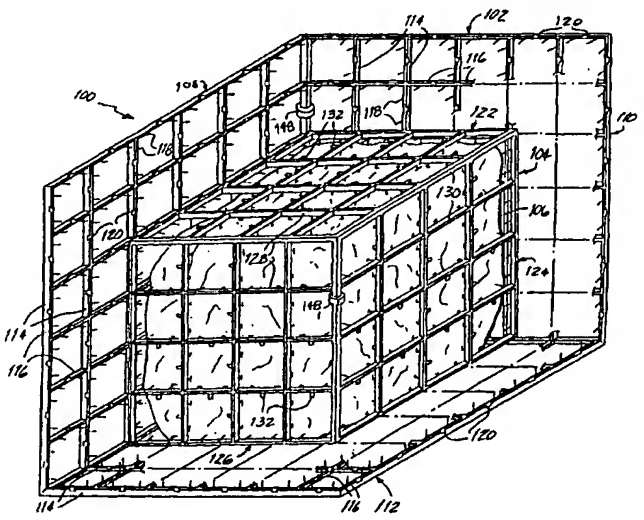
(54) Title: TISSUE SPECIMEN CARRIER



(57) Abstract: A carrier (100) and method of using to orient and maintain an excised tissue sample (106) in an orientation sufficient to determine its position in a body. The carrier (100) permits radiological and pathological evaluation of a precisely and accurately oriented tissue specimen (106). The carrier (100) has a first mating piece (102) that couples to a second mating piece (104) to define an enclosure for containing an excised tissue specimen (106). The specimen (106) is marked and maintained in its in vivo orientation from the time of excision and is evaluated for localization and orientation of a tumor during radiological and/or pathological assessment. The carrier (100) and method increase the accuracy and efficiency of diagnosis and any subsequent treatment.

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TISSUE SPECIMEN CARRIER

Related Applications

This application is a Continuation-In-Part application of United States Patent Application Serial No. 09/189,387 filed November 10, 1998, now pending.

Field of the Invention

The invention relates to a carrier to maintain an excised tissue specimen such as a breast biopsy specimen in a defined and stable orientation throughout subsequent processing and evaluation.

Background

Mammography is a noninvasive screening method for early detection of breast cancer. By pinpointing lesions as small as a few millimeters for further evaluation, mammography is an effective way to detect early-stage breast cancer, leading to increased treatment efficacy and decreased morbidity and mortality. The prevalence of mammography has led to increased follow-up evaluation including surgical biopsies of suspicious lesions or masses.

Among the diagnostic evaluation protocols, gross and microscopic pathological examination of excised suspicious tissues is routinely performed. This often consists of macroscopically examining the intact tissue, then histologically processing the tissue for subsequent microscopic evaluation of one or more stained serial sections. In addition, radiologic evaluation of the tissue, either in an intact form or in serial sections, may be performed.

In evaluating an excised tissue sample for the presence of malignant, pre-malignant or suspicious cells, it is useful if the tissue is maintained in an undistorted manner and in the exact orientation from which it was removed from the body. Maintaining tissue orientation permits a clinician to determine the extent of any malignancy that may be present; for example, if the tissue margins are free from malignant cells, the clinician is given greater assurance that the entire lesion was excised. This lessens the need for subsequent or more invasive surgery or other procedures. In contrast, if the tissue margins contain malignant, pre-malignant or suspicious cells, further surgery may be desirable to ensure that more or all of a mass is removed.

A variety of devices are available for securing and transporting such excised tissues for pathologic and/or radiologic evaluation. For example, tissue samples can be sandwiched and compressed between two plates, with the plates forming a grid for locating a mass within a tissue sample during subsequent radiological and pathological evaluation. As another example, tissue samples may be contained in carriers that have multiple compartments to contain core tissue samples as well as peripheral tissue samples to ensure

the core tumor as well as the surrounding tissue is evaluated. As still another example, tissue samples may be contained in molds that vertically orient specimens prior to histological embedding and processing. None of these devices, however, minimize distortion of the tissue and maintain tissue orientation during transport and radiological and/or pathological evaluation so that, for example, accurate assessment of tissue margins may be made.

Summary of the Invention

The invention is directed to a tissue specimen carrier that minimizes specimen distortion and maintains in vivo orientation of the tissue from excision throughout transport and radiological and/or pathological evaluation.

The carrier has two halves which, after placement of the tissue specimen in one of the halves, mate to form a whole carrier in which the specimen is prevented from shifting position and thus is stably contained. In accordance with the principles of the present invention, one embodiment of the carrier includes first and second mating pieces. First mating piece has a plurality of sides with at least one side having a grid of intersecting elongated members defining apertures therebetween. The second complimentary mating piece also has a plurality of sides with at least one side having a grid of intersecting elongated members defining apertures therebetween. Preferably, one of the two mating pieces is radiographically transparent and the other mating piece is radiographically dense. The second mating piece is adapted to selectively couple to the first mating piece to define an enclosure in which a tissue specimen is securely held in a known orientation. Preferably, both

first and second mating pieces have three mutually perpendicular sides. In one aspect of the invention, the sides of the second mating piece may be trimmed such that the enclosure formed by coupling the first and second mating pieces may be sized to substantially conform to tissue specimens of various sizes. In another aspect of the invention, the sides of both first and said second mating pieces include interiorly projecting spikes adapted to contact the tissue specimen upon coupling the second mating piece to the first mating piece.

In still another aspect of the invention, the elongated members of the first mating piece have interiorly opening notches formed therein and elongated members of the second mating piece having projecting members adapted for insertion into the notches to selectively couple the second mating piece to the first mating piece.

In another embodiment the carrier includes first and second mating pieces. Both the first and second mating piece have three mutually perpendicular sides with each side having a plurality of spaced-apart, elongated members. The elongated members of the first mating piece slidingly engage the elongated members of the second mating piece thereby coupling the first mating piece to the second mating piece to define an enclosure in which a tissue specimen is securely held in a known orientation. Preferably, the elongated members of one side of both the first and second mating piece are at an angle relative to one corner edge formed between two mutually perpendicular sides. In addition, at least one side of both the first and second mating pieces includes interiorly projecting spikes adapted to contact the

tissue specimen upon slidingly coupling the second mating piece to the first mating piece.

As will be appreciated, a clinician using the inventive carrier is assured that the excised tissue specimen that is being viewed on an x-ray film and/or on a gross or microscopic section can be oriented relative to the specimen as it was positioned in the body. This is of importance to determine where, and/or to what extent, further tissue must be removed, that is, accurate margin assessment. This will ensure that adequate tissue excision will occur where and to the extent it is needed to provide specimens with clear, i.e., free of pathology, margins, but also that additional tissue excision will not occur at margins indicating no abnormality. For example, excised breast tissue is obtained from a biopsy, a lumpectomy, or a mastectomy. For physiological and psychological reasons, along with economic and general health reasons such as recovery time, one wants to remove all abnormal and questionable tissue, while leaving intact as much normal tissue, as possible. These and other advantages of the invention will be further understood with reference to the following figures and detailed description.

Brief Description of the Drawings

FIG. 1 is a perspective view of the tissue specimen apparatus containing an excised and oriented tissue specimen.

FIG. 2 is a perspective view of an oriented excised tissue specimen.

FIG. 3 is a perspective view of a tissue specimen prepared for sectioning.

FIG. 4 is a cross-sectional view of the apparatus taken along line 4-4 of FIG. 1.

FIG. 5 is a perspective view of another embodiment of a tissue specimen carrier.

FIG. 6 is a perspective view of a first of the tissue specimen carrier of FIG. 5.

FIG. 7 is a perspective view of a second half of the tissue specimen carrier of FIG. 5.

FIG. 8 is an enlarged disassembled perspective view (as seen from the interior of the apparatus) of a first part of the tissue specimen carrier mating with a second part.

FIG. 9 is a cross-section taken along line 9-9 of FIG. 8.

FIG. 10 is a cross-section taken along line 10-10 of FIG. 8.

FIG. 11 is a schematic plan view of a first half of the tissue specimen carrier of FIG. 5 prior to being formed into a three-dimensional structure.

FIG. 12 is a perspective view of another embodiment of a tissue specimen carrier.

FIG. 13 is a perspective view of a second half of the tissue specimen carrier of FIG. 12.

FIG. 14 is an elevational end view of the tissue specimen carrier of FIG. 12.

FIG. 15 is an elevational side view of the tissue specimen carrier of FIG. 12.

Detailed Description

As shown in FIG. 1, a tissue specimen carrier 10 to contain and maintain an excised tissue specimen 12 in a defined orientation relative to its removal from a body is disclosed. The excised tissue specimen 12 may be a biopsy or other specimen known or suspected of containing a tumor, lesion, cyst or mass of cells that requires further diagnostic or therapeutic evaluation or examination, for example, to determine if malignant, pre-malignant, suspicious or otherwise abnormal cells are present.

In one embodiment, the carrier 10 comprises an outer compartment or box 20 that is open at at least one face 22 for stably containing and maintaining the excised specimen 12 in a known and fixed orientation, and a slidably insertable inner compartment or box 24 to secure and conform the specimen 12 contained therein. While a rectangular shaped box is preferable for ease of subsequent histological processing, the carrier 10 is not limited to this shape and may be, for example, square, circular or any other geometric shape. The outer box 20 and inner box 24 are preferably completely separable, but they may also form a unitary device with the outer box 20 and inner box 24 connected by, for example, a hinge or other connector. In one embodiment, a series of different sized carriers 10 are available to accommodate various sized biopsy specimens 12. A surgeon or practitioner then selects the carrier 10 that is sized to either just accommodate a tissue specimen 12 or to contain a smaller-sized specimen 12. Preferably, the carrier 10 is sized to encompass specimens 12 ranging from about 2 x 2

cm to about 10 × 8 cm, and may range from about one to about five times the specimen 12 size.

In this embodiment, the outer box 20 and inner box 24 are made of a radiographically transparent material 26. Examples of such radiographically transparent material 26 are extruded plastics, which may be either clear or colored. The edges or beams are preferably thin so the carrier 10 can be cut or otherwise easily opened during subsequent tissue processing. It is preferred that the material 26 is also visually transparent to allow gross inspection of the specimen 12 contained therein.

The material 26 may have an orientation marking system 39 stamped or otherwise applied or indicated thereon to allow a surgeon to select a marking 39 for a particular orientation. The marking system 39 may be a coordinate system such as an x, y, z coordinate system 39 with which medical personnel are familiar, or another system. The system 39 is preferably visible on radiographic films to allow a radiologist to maintain orientation of the specimen 12 while viewing the films.

As shown in FIG. 4, the interior surface 31 of the outer box 20 may have one or more projections or barbs 33. The barbs 33 are preferably located in a region of the inner surface 31 that will contact the specimen 12 and may serve to secure the specimen 12 in the carrier 10. The barbs 33 may be of any material but are preferably the same material 26 as the carrier 5 and can be configured to project inwardly from an aperture 30. The barbs 33 are preferably about 1-5 mm long and may terminate in a substantially pointed tip so that they contact a portion of specimen 12 to assist in securing the

specimen 12 in the carrier 10. In this embodiment, a contact of about one to a few mm into the specimen 12 is sufficient as long as the barb 33 catches or hooks into a portion of the specimen 12. In an alternative embodiment, the barbs do not hook into the specimen 12 but provide an external barrier to movement of the specimen 12 within the outer box 20.

The carrier 10 is configured so that the material 26 defines a plurality of apertures 30, preferably having a square shape and preferably sized to accommodate a monofilament suture. The aperture 30 size is preferably in the range of about 1 mm to about 9 mm. The apertures 30 are preferably regularly spaced 32 to form grids of about 1 cm and are preferably present through each face 34 of the outer box 20 and through at least two opposing faces of the inner box 24.

With reference to FIG. 2, in use, a tissue sample 12 is excised from the body and is placed in the outer box 20 in the exact orientation from which it was located in and removed from the body. The tissue sample frequently is suspected of containing or may in fact be known to contain a tumor, mass, lesion, or cluster of suspicious or abnormal cells 36. The sample 12 may be, for example, breast tissue obtained by ultrasonographic or stereotactic guided core excision, excision preceded by insertion of a wire under mammographic guidance for localization of an impalpable abnormal shadow or microcalcification (needle localization biopsy), lumpectomy of a defined or palpable mass or from a partial or total mastectomy. The method and device, however, are not limited to use with breast tissue specimens and may be used with any excised solid tissue specimen, preferably requiring

orientation with further evaluation such as a cyst or a solid organ specimen, for example, a liver biopsy specimen.

The invention permits a tissue specimen 12 to be accurately and fixedly maintained in the exact orientation as it was located and positioned in vivo. The excised specimen 12 is initially oriented by marking the specimen 12, usually visually marking using any convenient means such as placing any type of device or combination of devices such as pins, clips, sutures, etc. on or into the specimen 12. In one embodiment, the specimen 12 is oriented by placing sutures 40 of varying lengths at one or more defined positions in the specimen 12. For example, a shorter suture 42 may be placed at the superior extreme 44 of the specimen 12, and a longer suture 45 may be placed at a lateral extreme 46 of the specimen 12.

The specimen 12 thus oriented is placed into the outer box 20 of the carrier 10. It is particularly convenient to place the specimen 12 into the carrier 10 by grasping the specimen 12 by its anterior surface 48 and placing it into the carrier 10 by inserting the specimen 12 through at least one open face 22 so that its superior extreme 44 is oriented to the craniocaudacad (CC) face and the lateral extreme 48 is oriented to the mediolateral (ML) face.

The carrier 10 is selected from among a plurality of different-sized carriers to either just accommodate the specimen 12 or to be in the range of preferably about one to five times larger than the specimen 12. An appropriately sized carrier 10 permits fixed and stable transport of a specimen 12. However, it will be appreciated that while a carrier 10 that is sized to be in the range of about one to about five times as large as the

specimen 12 is preferred, any carrier 10 that is either the same size or larger than the specimen 12 may be used.

The interior compartment or box 24 is then inserted into the outer box 20 and is adjusted to stably contain the specimen 12 within the outer box 20. This is most easily accomplished by exerting a minimal compressive force, preferably by hand, on a surface of the inner box 24 sufficient for the inner box 24 to touch the outer surfaces of the specimen 12. A minimally compressive force is one that serves to substantially conform the specimen 12 to at least one surface of the inner box 24 and to preferably form the specimen 12 in a substantially rectangular shape. This shape aids in subsequent tissue processing. The force further fixedly maintains the oriented tissue specimen 12 within the carrier 10, and also textures or nubs 50 the specimen surface. Sufficient texturing or nubbing on the surface of the specimen 12 is achieved by the regularly spaced, preferably square shaped apertures 30 and facilitates free-hand serial sectioning of the specimen 12.

After orientation of the specimen 12 is verified, the specimen 12 is secured within the inner box 24. This may be accomplished as the specimen 12 contacts the barbs 33 that inwardly project on an interior surface 31 of the outer box 20. This may additionally or alternatively be accomplished by inserting a suture 40 through an aperture 30 of the outer box 20 so that the suture 40 is inserted into the specimen 12. The inner box 24 is further secured in the outer box 20. In one embodiment, the inner box 24 is secured by an additional securing means, for example, by a straight suture 40 inserted

through apertures 30a, 30b (not shown) in both the inner box 24 and outer box 20.

The specimen 12 that is oriented and fixed in an appropriately sized carrier 10 is then subjected to radiography. For example, the carrier 10 is placed against a photographic film and is exposed to x-rays. Radiographic films are obtained in both the CC and ML projections, corresponding to the orientation of any suspected lesion or mass 36 visualized on the film. Ideally, both the radiologist and surgeon view the film and may consult to determine whether to excise additional tissue. Additional tissue would likely be required if, for example, the film showed that the margins of the excised tissue 12 contained a suspicious or abnormal area or shadow.

The specimen 12, still maintained in an oriented and fixed position in the appropriately sized carrier 10, is then subjected to pathological evaluation. The carrier 10 may be transported for pathological evaluation by any timely means that will not compromise the specimen 12 orientation and integrity. The specimen 12 stably maintained in the carrier 10 is then subjected to histological processing. For example, the specimen 12 may be treated to cause tissue fixation and render the cellular structural components insoluble by immersing the carrier 10 containing the specimen 12 in a rapid fixation system solution, such as a solution of 70-30 formyl alcohol (formalin 70% and isopropanol 30%) for at least four hours and up to about eighteen hours.

With reference to FIG. 3, after fixation the specimen 12 having roughly a rectangular shape and a nubbed surface is removed while still

maintaining orientation. Removal of the specimen 12 may be by any means that maintains orientation and integrity of the specimen 12. For example, the specimen 12 may be removed by grasping a laterally placed suture 45, either directly or using a device such as forceps or a hemostat, and applying gentle force to dislodge the specimen 12 from the carrier 10. As another example, the specimen 8 may be removed by cutting through the carrier 10, for example, at a thin edge, using any appropriate cutting tool such as a scalpel or scissors.

The specimen 12 is then immediately coded to differentiate each surface 44, 46, 48. This may be done, for example, by painting each surface 44, 46, 48 of the specimen 12 with a different colored ink and fixing the ink with a chemical mordant.

The specimen 12 is then sectioned in accordance with standard pathologic technique, for example, in a sagittal plane for subsequent processing. The fixed tissue specimen 12 is embedded or infiltrated with a solution of paraffin or other solution that solidifies so that the tissue and the embedding matrix may be sectioned together. The fixed, ordered and oriented sections 60 may be further evaluated radiologically. This would be of use, for example, in the case where microcalcifications, an early indicator of tumor formation in breast tissue, were noted and required closer evaluation. Alternatively or additionally, the sections 60 may be placed in cassettes or other types of suitable packaging for further histological processing such as staining for pathological evaluation.

Another embodiment of a tissue specimen carrier is illustrated in FIGS. 5-11 and is described in greater detail below. With specific reference to FIG. 5, a tissue specimen carrier 100 is comprised of first and second mating pieces 102, 104. First and second mating pieces 102, 104 are selectively coupled together to securely hold or contain an excised tissue specimen 106 in a predetermined orientation. First and second mating pieces 102, 104 are preferably made of clear plastic and are resistant to chemicals used in histological processing, such as a 10% formaldehyde solution and ethanol. The plastic is sufficiently stiff to ensure that the carrier 100 is substantially rigid. The carrier 100 is not autoclaveable but may be sterilized by gamma irradiation or any other suitable method and shipped in a sterile condition.

With reference to FIG. 6, first mating piece 102 has three mutually perpendicular sides 108, 110, 112. Each side 108, 110, 112 is formed by an array of intersecting elongated members 114, 116. Preferably, elongated members 114, 116 intersect at right angles to provide a uniform grid by which the tissue specimen 106 may be oriented. Elongated members 114, 116 are spaced 1 cm apart, respectively, from adjacent elongated members 114, 116. The spacing between elongated members 114, 116 is not limited to 1 cm and could be greater or less than 1 cm, depending on the particular application. Preferably, each side 108, 110, 112 is a 6 cm by 6 cm square, but is not limited to this size and could be extended or shortened in either dimension depending on the particular application.

A plurality of equally spaced spikes 118 project toward the interior of first mating piece 102 from elongated members 114, 116. Preferably, spikes 118 are about 5 mm in length and are spaced 5 mm apart along each elongated member 114, 116. Elongated members 114, 116 further include notches 120 which, as explained in greater detail below, are used to selectively couple second mating piece 104 to first mating piece 102. First mating piece 102 is preferably made of a material that is radiographically dense, such as polypropylene doped with calcium. Because first mating piece 102 is radiographically dense, elongated members 114, 116 will be visible on an X-ray, thereby providing a visual reference grid relative to the tissue specimen 106 upon radiographic examination.

With reference to FIG. 7, second mating piece 104 is comprised of three mutually perpendicular sides 122, 124, 126. Like first mating piece 102, each side 122, 124, 126 is comprised of an array of elongated members 128, 130, preferably intersecting at right angles to one another. Elongated members 128, 130 are spaced apart, respectively, 1 cm from one another. Preferably, each side 122, 124, 126 is a 6 cm by 6 cm square. Elongated members 128, 130 further include spikes 118 which project toward the interior of second mating piece 104. As shown in FIG. 5, spikes 118 contact and in some instances penetrate tissue specimen 106 in order to assist in maintaining the tissue specimen 106 in a predetermined orientation. Elongated members 128, 130 also include projections 132 which are sized to be inserted into notches 120 on elongated members 114, 116 to selectively couple second mating piece 104 to first mating piece 102. Second mating piece 104

is not radiographically dense, i.e., it is radiographically translucent or substantially invisible on an X-ray. Accordingly, second mating piece 104 may made of polypropylene not doped with calcium.

When second mating piece 104 mates with first mating piece 102, it forms a tissue specimen carrier 100 that is a 6 cm by 6 cm by 6 cm box. However, according to one aspect of this embodiment, the second mating piece 104 can be cut or trimmed, for example, with a pair of scissors 134, so that the size of the enclosure formed by mating first and second mating pieces 102, 104 can be altered to more closely approximate the size of the excised tissue specimen 106. Properly sizing the enclosure further assists in maintaining the tissue specimen 106 in the proper orientation within the tissue specimen carrier 100. For example, a tissue specimen which is approximately 4 cm by 4 cm by 4 cm may better be maintained in the proper orientation if the second mating piece 104 is trimmed so that the resultant enclosure is approximately 4 cm by 4 cm by 4 cm. To that end and in accordance with the principles of the present invention, cutting or trimming means such as a scalpel or scissors 134 are used to cut elongated member 130 at its intersection with elongated member 128 to trim second mating piece 104 such that when it mates with first mating piece 102, a 4 cm by 4 cm by 4 cm enclosure is formed around the tissue specimen 106 (FIG. 5). It is contemplated that the second mating piece 104 would not be trimmed further than that required to form a 2 cm by 2 cm by 2 cm box. As such, there are no projections 132 on elongated members 128 and 130 within 2 cm of the corner intersected by the sides 122, 124, 126. However, should a

smaller enclosure be necessary, a second mating piece 104 with projections 132 along the entire length of elongated members 128 and 130 could be used.

With reference to FIG. 8, projection 132 on elongated member 128 is shown being inserted into notch 120 of elongated member 114 to couple second mating piece 104 to first mating piece 102. Each elongated member 114, 116 includes a channel 136 formed in part by opposing walls 138, 140 which extend the length of elongated members 114, 116. Along elongated member 114, a portion of wall 140 is cut out to form part of notch 120. As such, a portion of projection 132 resides in the space created by the cut out in wall 140 (FIG. 9). In one embodiment, to assist in inserting projection 132 into notch 120, projection 132 includes a flexible lip 142 which deforms slightly when inserted into notch 120. Spikes 118 are attached along wall 138 of elongated member 114, thus helping guide elongated members 128 into position as projection 132 is inserted into notch 120 and channel 136 (FIG. 10).

Elongated members 114, 116 are preferably 4 mm deep and 1.5 mm wide, with walls 138, 140 being 0.25 mm wide and channel 136 being 1 mm deep. Elongated members 128, 130 are of similar dimensions but do not contain the cut out along wall 140 which forms part of notch 120. Projection 132 has a diameter of about 1.25 mm where flexible lip 142 is about 0.5 mm deep.

As shown in FIGS. 6 and 7, first and second mating pieces 102, 104 are three dimensional pieces. It is contemplated, however, that first and second mating pieces 102, 104 could be manufactured as substantially two-

dimensional planar pieces and then folded into three-dimensional pieces. For example, as shown in FIG. 11, side 108 of first mating piece 102 is attached to side 112 by a living hinge 144. Side 110 is connected to side 112 by living hinge 146. After first mating piece 102 is formed, sides 110, 108 are bent upward along living hinges 144, 146 to form the three-dimensional structure shown in FIG. 6. A clamp or band 148 (FIG. 6) is used to secure sides 108, 110 in their upright position. A similar manufacturing technique can also be used to form second mating piece 104.

Another embodiment of a tissue specimen carrier is illustrated in FIGS 12-15 and is described in greater detail below. With specific reference to FIG 12, a tissue specimen carrier 200 is comprised of first and second mating pieces 202, 204. As in the previous embodiments, first and second mating pieces 202, 204 are selectively coupled together to securely hold or contain an excised tissue specimen 206 in a predetermined orientation. As in the above-described embodiment shown and described in FIGS. 5-11, first and second mating pieces 202, 204 are preferably made of clear plastic and are resistant to chemicals used in histological processing, such as a 10% formaldehyde solution and ethanol. The plastic is sufficiently stiff to ensure that the carrier 200 is substantially rigid. The carrier 200 is not autoclaveable but may be sterilized by gamma irradiation or any other suitable method and shipped in a sterile condition.

First and second mating pieces 202, 204 are essentially identical in their geometric configuration. Preferably, however, first mating piece 202 is made of a material that is radiographically dense, such as polypropylene

doped with calcium, and is therefore viewable on a conventional X-ray. Conversely, second mating piece 204 is not radiographically dense, i.e., it is radiographically translucent, and may be made from polypropylene not doped with calcium. Because first and second mating pieces are essentially identical, the following discussing regarding second mating piece 204 would apply to first mating piece 202 and like reference numerals will be applicable to first mating piece 202.

With reference to FIG. 13, second mating piece 204 is comprised of three mutually perpendicular sides 208, 210, 212 which intersect to form edges 214, 216, 218. Sides 208 and 210 have elongated projections 220, 222, respectively, which extend perpendicularly from edges 214, 218, respectively. In contrast, side 212 has elongated projections 224 which extend at an angle α, preferably 45°, relative to edge 218. Preferably, each side 208, 210, 212 is a 6 cm by 6 cm square, but is not limited to this size and could be extended or shortened in either dimension depending on the particular application.

First and second mating pieces 202, 204 are configured to slidingly mate with one another to form an enclosure defined by portions of sides 208, 210, 212 to securely hold tissue specimen 206 therein. More specifically, and as shown in FIGS. 12, 14 and 15, finger-like members 220, 222 of sides 208, 210 of first mating piece 202 mate with finger-like members 224 of side 212 of second mating piece 204 in an interlacing manner. Similarly, finger-like members 220, 222 of sides 208, 210 of second mating piece 204 mate with finger-like members 224 of side 212 of first

mating piece 202. Once finger-like members 220, 222 and 224 are mated, first mating piece 202 is slid toward second mating piece 204, as indicated by the arrow in FIG. 15, forming an enclosure of tissue specimen 206. First and second mating pieces 202, 204 may include a fastening member (not shown) which would hold first and second mating pieces 202, 204 together once they are slid together. For example, the fastening member may be a ratcheting device which would allow the first mating piece 202 to slide relative to the second mating piece 204 to form the enclosure, but not allow the two mating pieces 202, 204 to thereafter slid apart.

The size of the enclosure around tissue specimen 206 can be selected such that it closely approximates the dimensions of the tissue specimen 206 and can thereby assist in maintaining the tissue specimen 206 in a predetermined orientation relative to the enclosure. As can be seen in FIG. 14, a subset of the total number of finger-like members 220, 222 mate with finger-like members 224 to define a height H and a width W of the enclosure. As fewer and fewer finger-like members 220, 222 are mated with finger-like members 224, the height H and width W of the enclosure decrease. It will be appreciated that the number of finger-like members 220 mated with finger-like members 224 need not equal the number finger-like members 222 mated with finger-like members 224. As such, the height H and width W of the enclosure can be tailored to more closely match the dimensions of the tissue specimen 206. After the first and second mating pieces 202, 204 are initially mated and the height H and width W have been selected, first mating piece 202 is slid toward the second mating piece 204 until they contact the tissue

specimen 206 having a depth D. Once the tissue specimen 206 is secured, the finger-like members 220, 222, 224 not used to form the enclosure, i.e, those finger-like members not mated with other finger-like members, may be trimmed for example, by scissors, to yield a more manageably sized tissue specimen carrier 200.

To assist in securing the tissue specimen 206 in a predetermined orientation, finger-like members 224 on both first and second mating pieces 202, 204 include spikes 226 which project inwardly toward the interior of the enclosure. Additional spikes 226 could be added along finger-like members 220, 222 if desired. If such spikes were added, they would be oriented so as to avoid interfering with the mating of finger-like members 220, 222 with finger-like members 224.

It should be understood that the embodiments of the present invention shown and described in the specification are only preferred embodiments of the inventor and are not limiting in any way. Therefore, various changes, modifications or alterations to these embodiments may be made or resorted to without departing from the spirit of the invention and the scope of the following claims.

1. A carrier for a tissue specimen comprising:

a first mating piece having a plurality of sides, at least one side having a grid of intersecting elongated members defining apertures therebetween; and

a second complimentary mating piece having a plurality of sides, at least one side having a grid of intersecting elongated members defining apertures therebetween, said second mating piece being adapted to selectively couple to said first mating piece to define an enclosure adapted to contain the tissue specimen.

2. The carrier of claim 1, wherein said plurality of sides of said first mating piece are mutually perpendicular to one another, and said plurality of sides of said second mating piece are mutually perpendicular to one another.

3. The carrier of claim 1, wherein a portion of each side of said second mating piece is selectively removeable such that at least one dimension of the enclosure formed by coupling of said first and second mating pieces may be decreased.

4. The carrier of claim 3, wherein the enclosure formed by said first mating piece and said second mating piece is substantially rectangular.

5. The carrier of claim 3, wherein the enclosure formed by said first mating piece and said second mating piece is substantially cubic.

6. The carrier of claim 1, wherein said plurality of sides of said first and said second mating pieces include interiorly projecting spikes adapted to contact the tissue specimen upon coupling said second mating piece to said first mating piece.

7. The carrier of claim 1, wherein one of said mating pieces is radiographically dense and the other mating piece is radiographically transparent.

8. A carrier for a tissue specimen comprising:

a first mating piece having three sides, each side having a grid of intersecting elongated members defining apertures therebetween, at least one elongated member having interiorly opening notches formed therein; and

a second complimentary mating piece having three sides, each side having a grid of intersecting elongated members, at least one of said elongated members of said second mating piece having projecting members adapted for insertion into said notches to selectively mate said second mating piece to said first mating piece to define an enclosure adapted to contain the tissue specimen.

9. The carrier of claim 8, wherein a portion of each side of said second mating piece is selectively removeable such that at least one dimension of the enclosure formed by coupling of said first and second mating pieces may be decreased.

10. The carrier of claim 8, wherein said first mating piece has three mutually perpendicular sides and said second mating piece has three mutually perpendicular sides.

11. The carrier of claim 8, wherein said elongated members of said first and second mating pieces include interiorly projecting spikes adapted to contact the tissue specimen upon coupling said second mating piece to said first mating piece.

12. The carrier of claim 8, wherein said elongated members of said first and second mating pieces include interiorly opening grooves extending along each of said elongated grids.

13. The carrier of claim 8, wherein one of said mating pieces is radiographically dense and the other mating piece is radiographically transparent.

14. A method of maintaining a tissue specimen excised from a body for subsequent evaluation in a defined orientation relative to the body comprising:

orienting said excised specimen relative to the body;

inserting said oriented excised specimen into a carrier comprising a first mating piece having a plurality of sides, at least one side of said plurality having a grid of intersecting elongated members defining apertures therebetween and a second complimentary mating piece having a plurality of sides, at least one side of said plurality having a grid of intersecting elongated members defining apertures therebetween;

mating said second mating piece with said first mating piece to form said carrier; and

maintaining said contained oriented excised specimen.

15. The method of claim 14 wherein one of said mating pieces is radiographically transparent.

16. The method of claim 14 further comprising transporting, evaluating, histologically processing, radiographically processing.

17. A carrier for a tissue specimen comprising:

a first mating piece having three mutually perpendicular sides, each side having a plurality of spaced-apart, finger-like members;

a second complimentary mating piece having three mutually perpendicular sides, each side having a plurality of spaced-apart, finger-like members, slidingly couplable with said finger-like members of said first mating piece to thereby define an enclosure adapted to contain the tissue specimen.

18. The carrier of claim 17, wherein the elongated projections of one side of both the first and second mating piece are oriented at an angle relative to one corner edge formed between two mutually perpendicular sides.

19. The carrier of claim 17, wherein at least one side of both first and second mating pieces includes interiorly projecting spikes adapted to contact the tissue specimen upon slidingly coupling said second mating piece to said first mating piece.

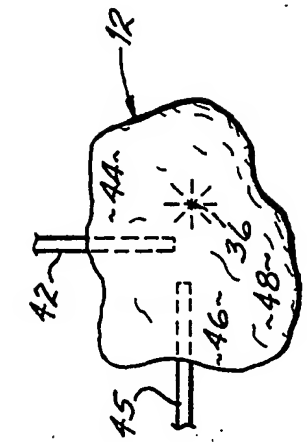

FIG. 2

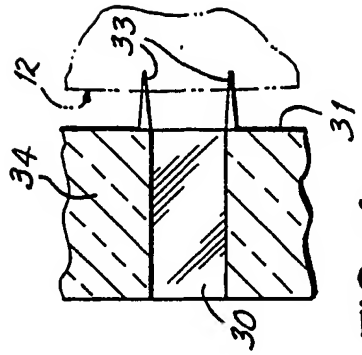

FIG. 4

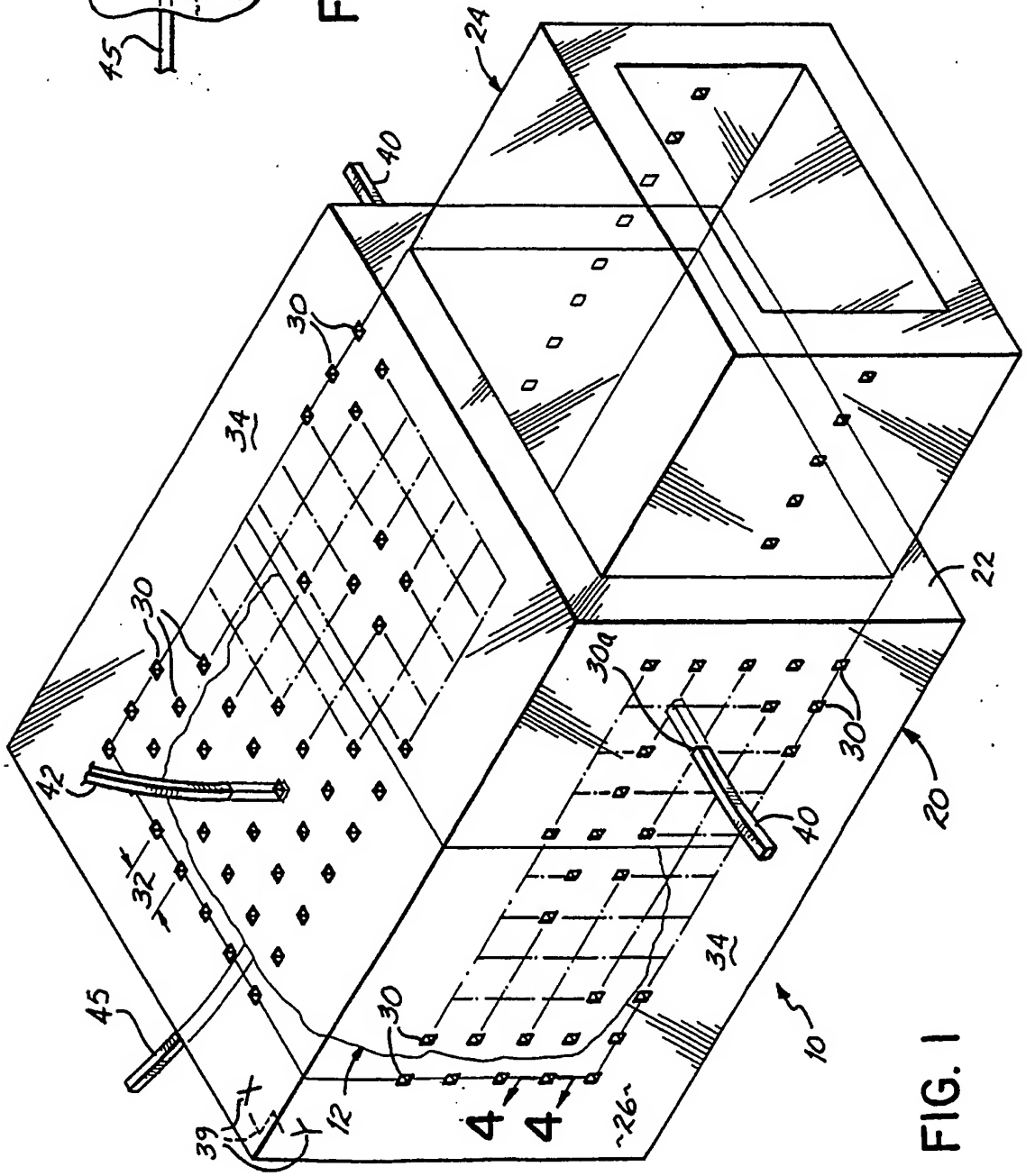

FIG. 1

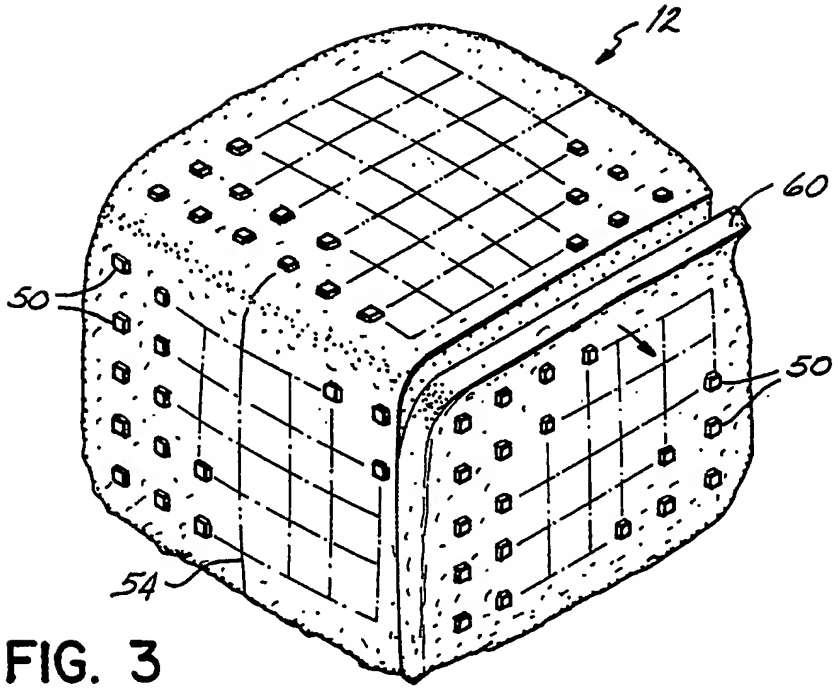

FIG. 3

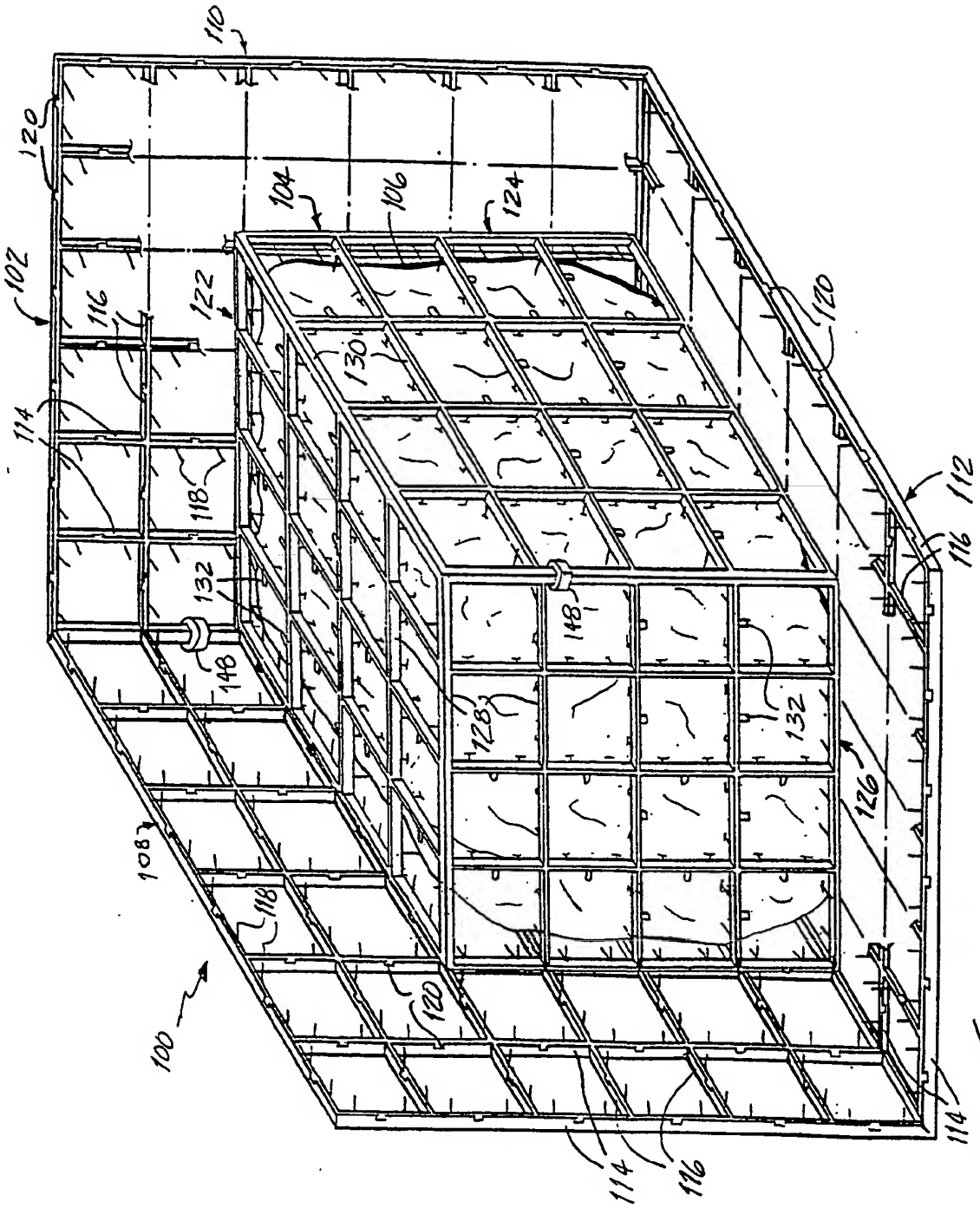
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FIG. 5

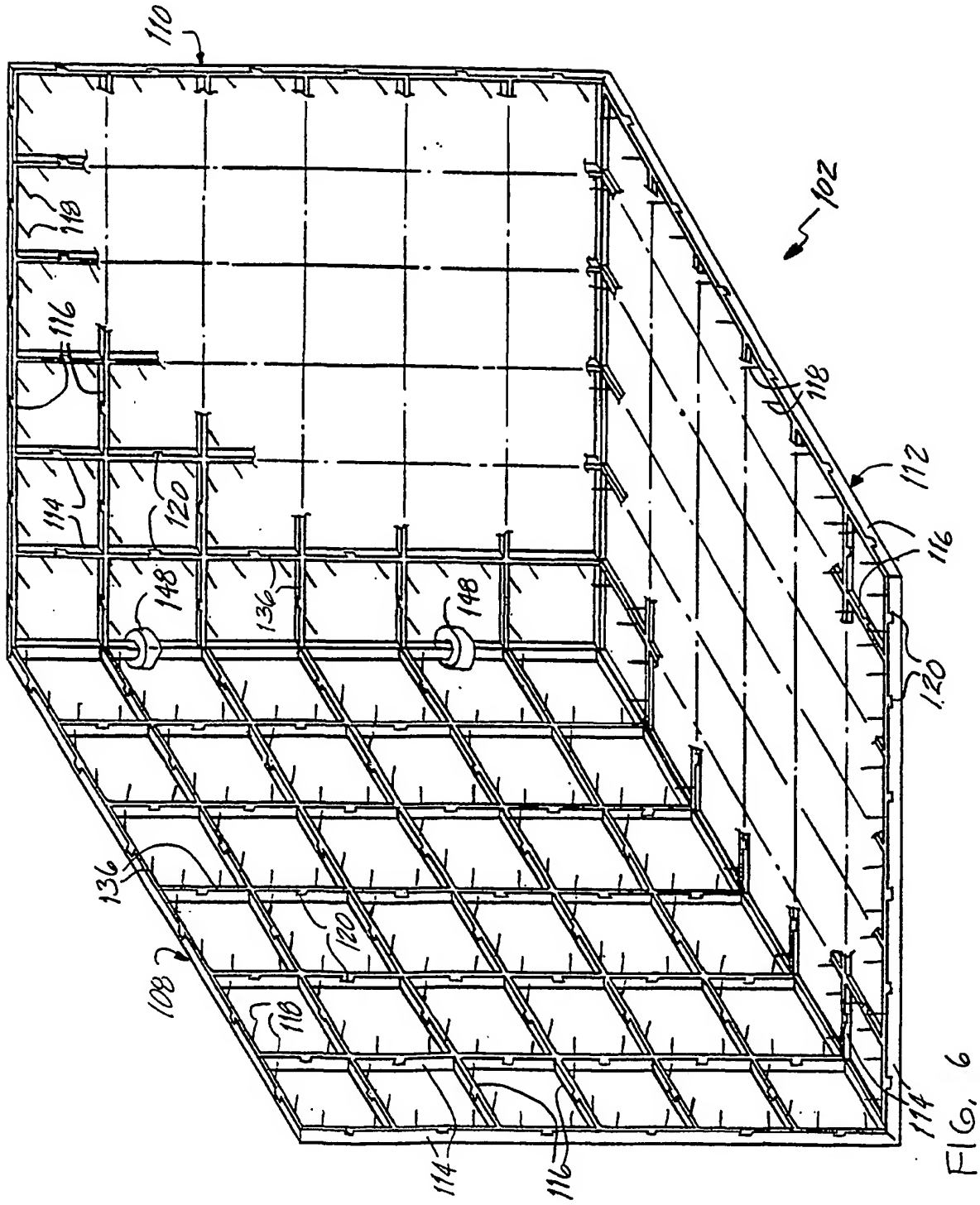

FIG. 6

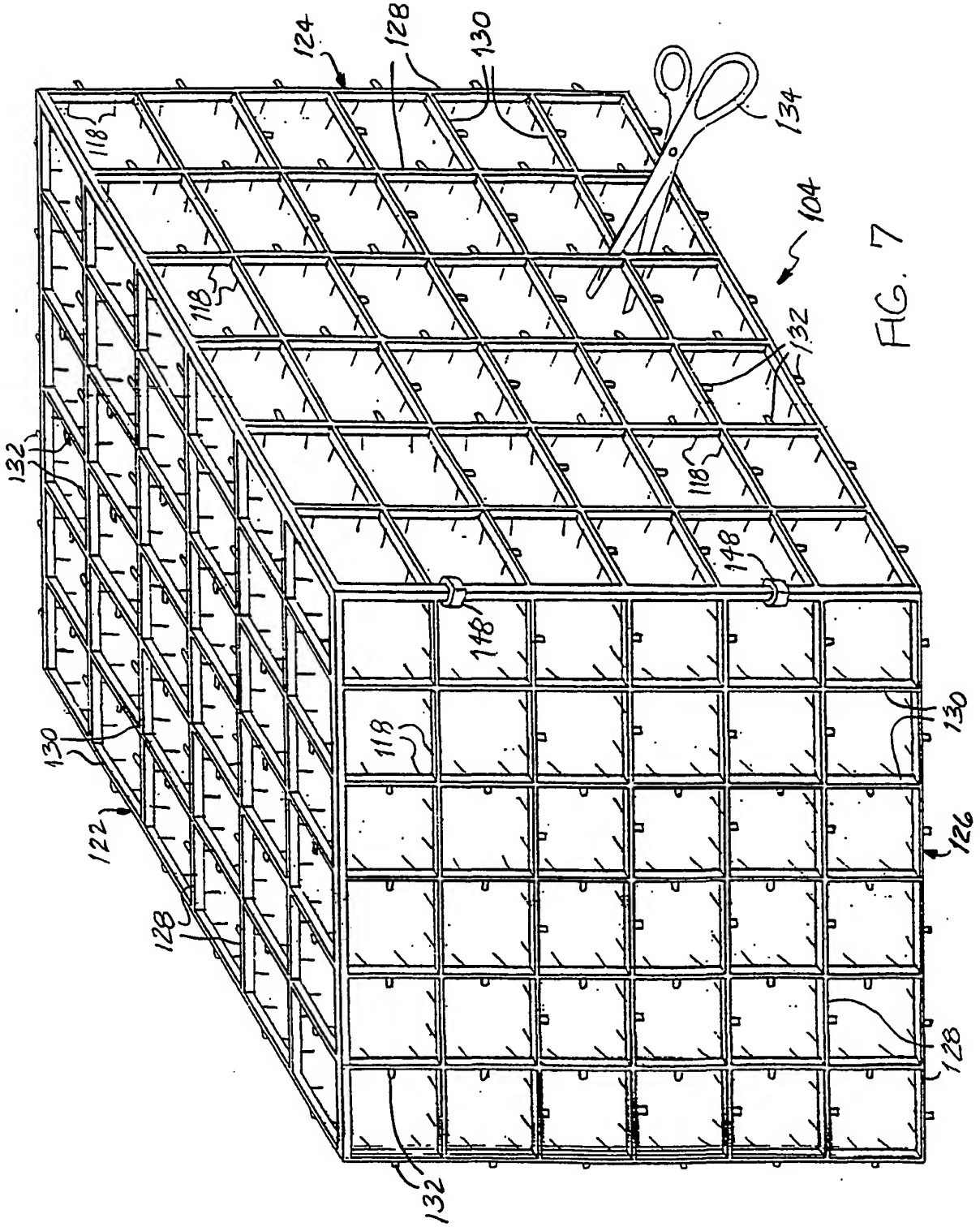

FIG. 7

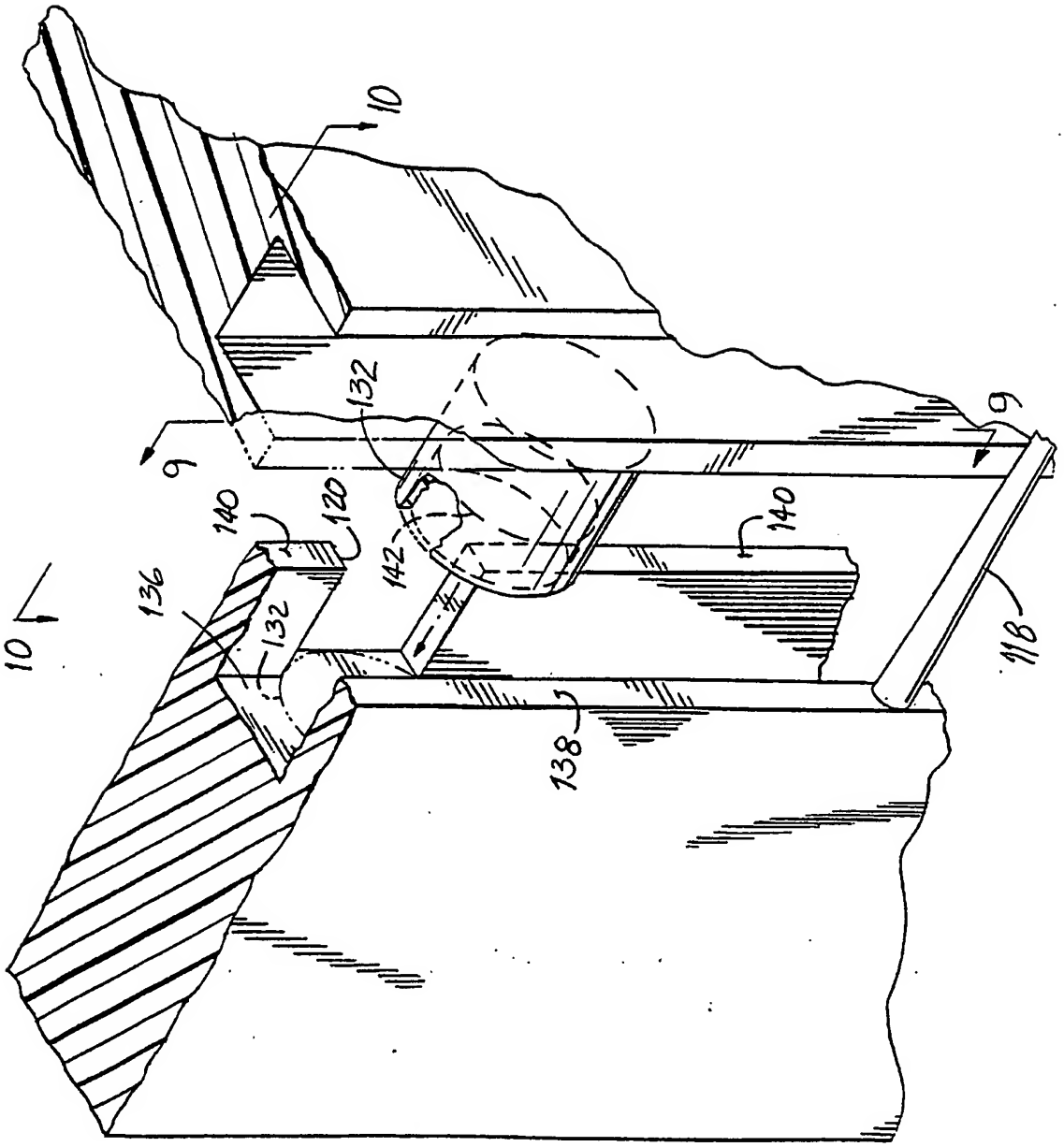

FIG. 8

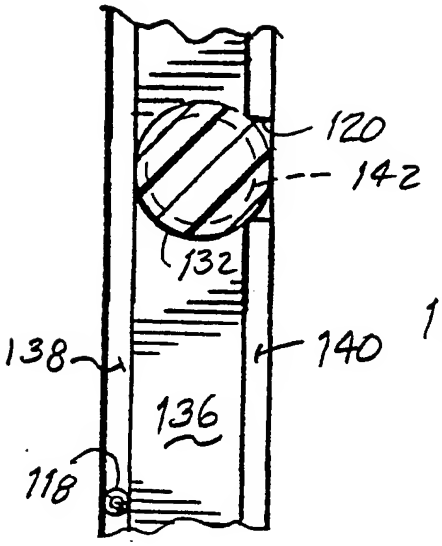

FIG. 9

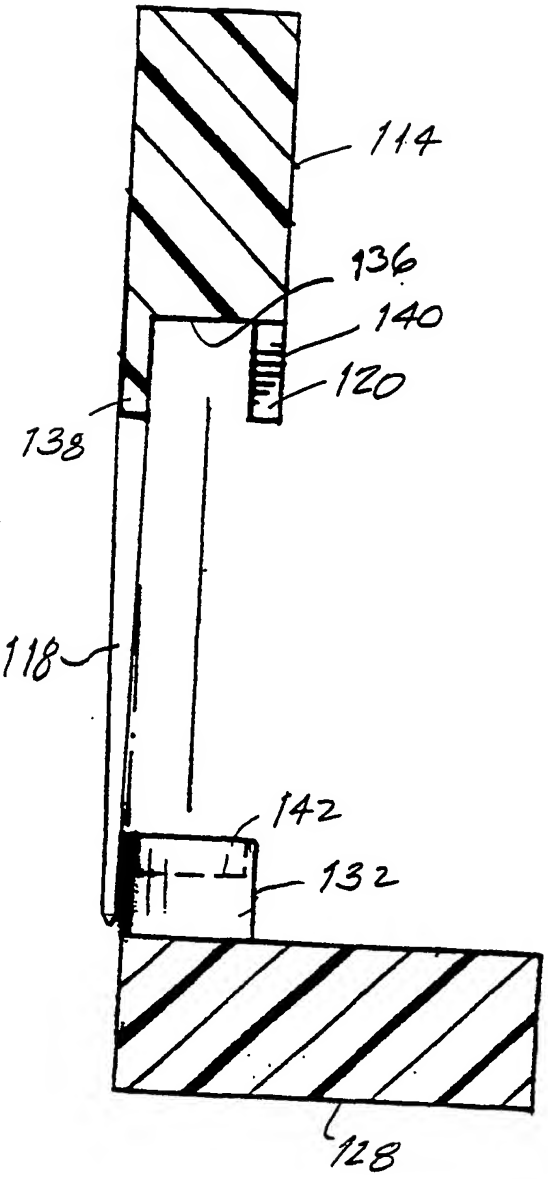

FIG. 10

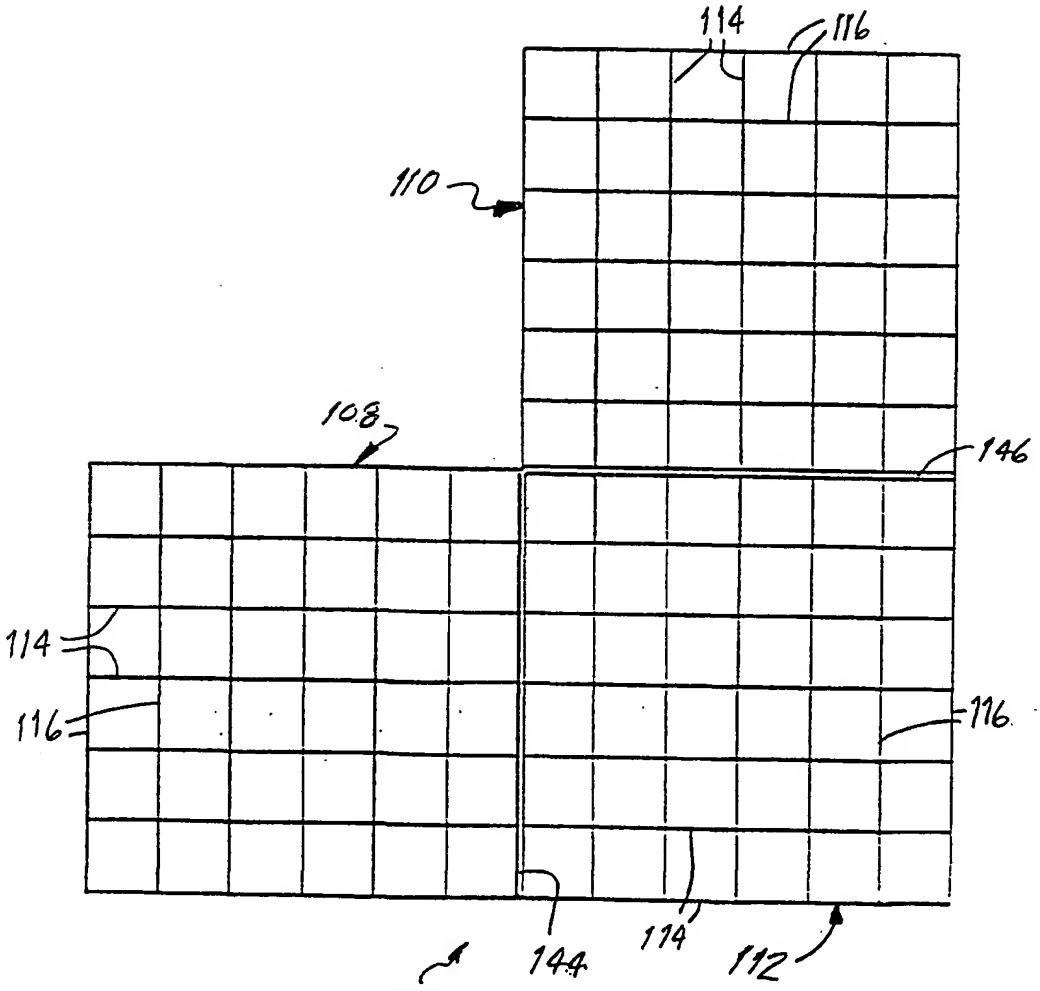

FIG. 11

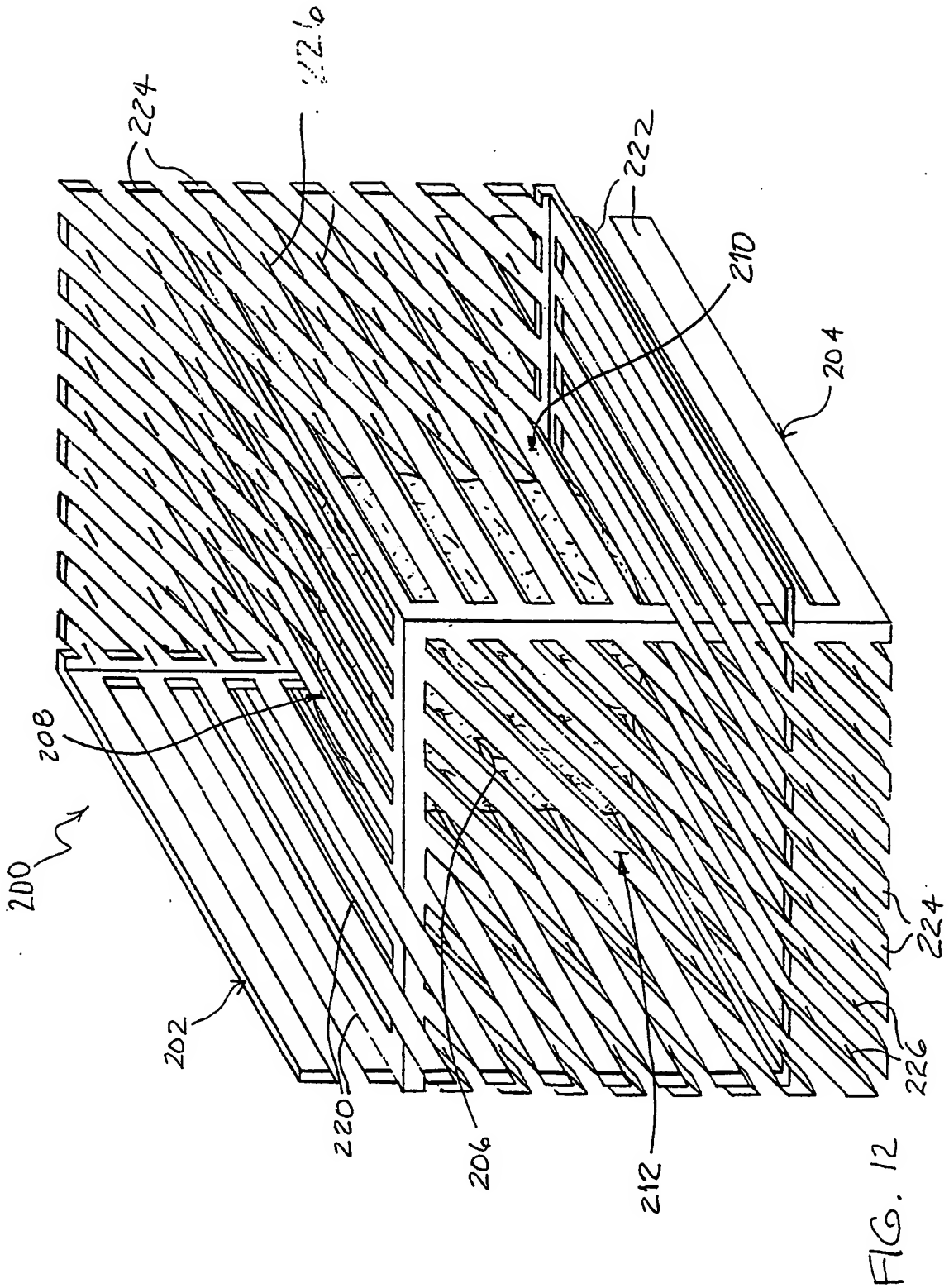

FIG. 12

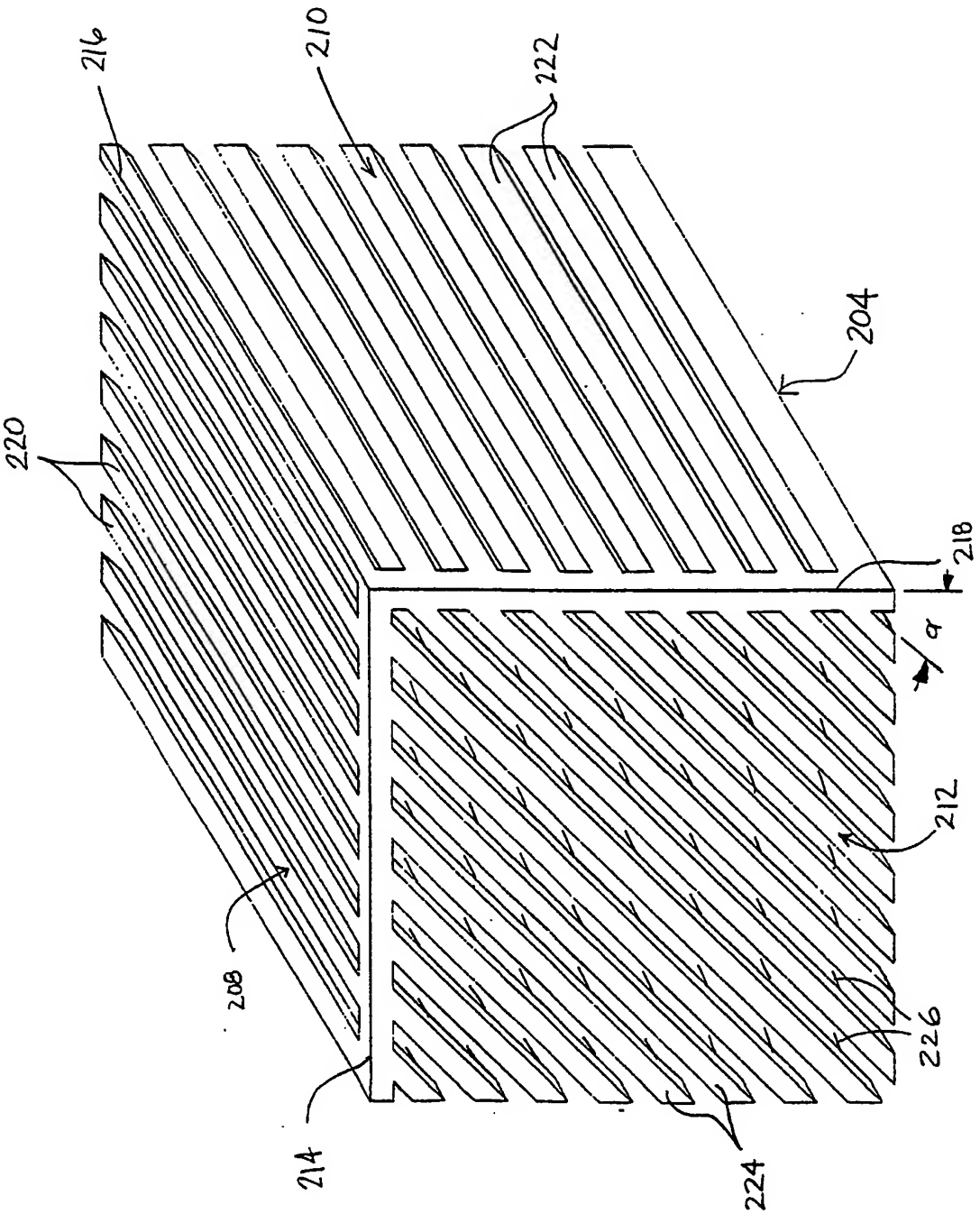

FIG. 13

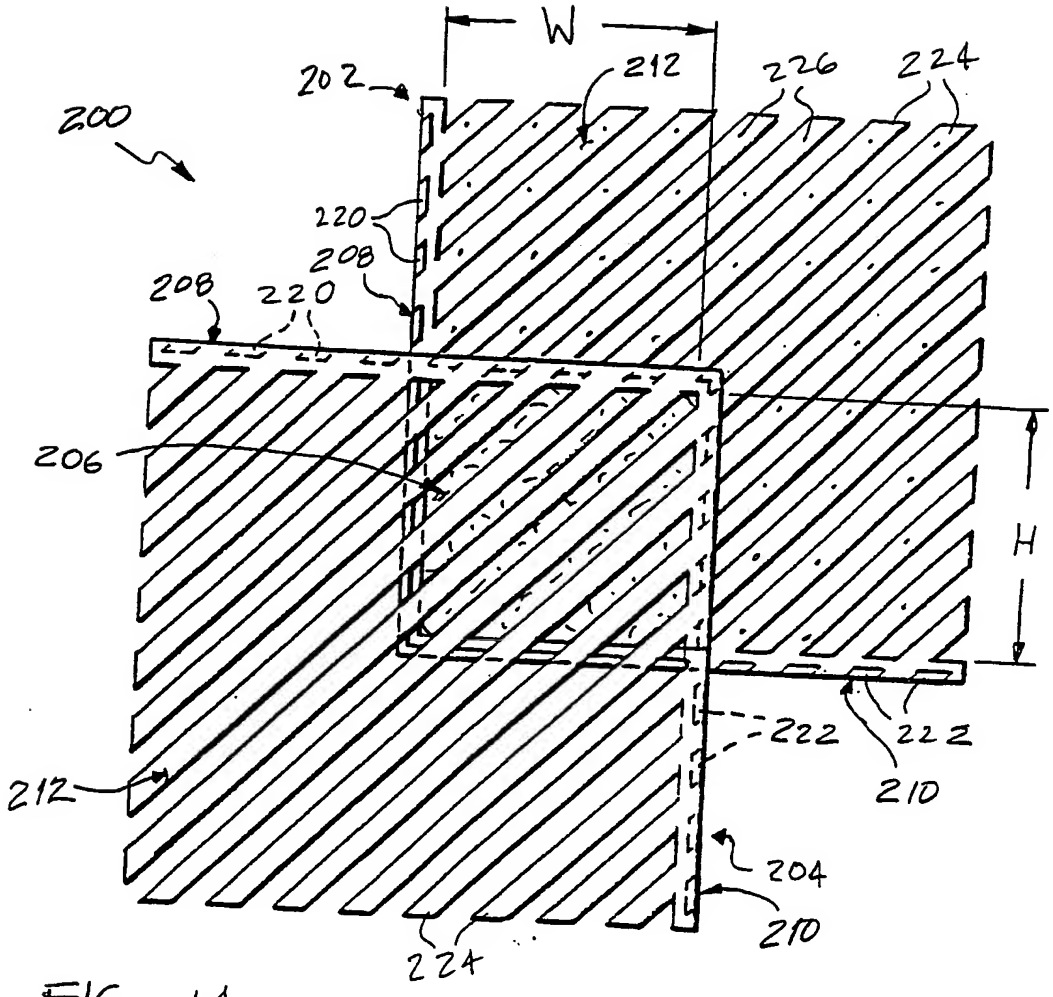
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FIG. 14

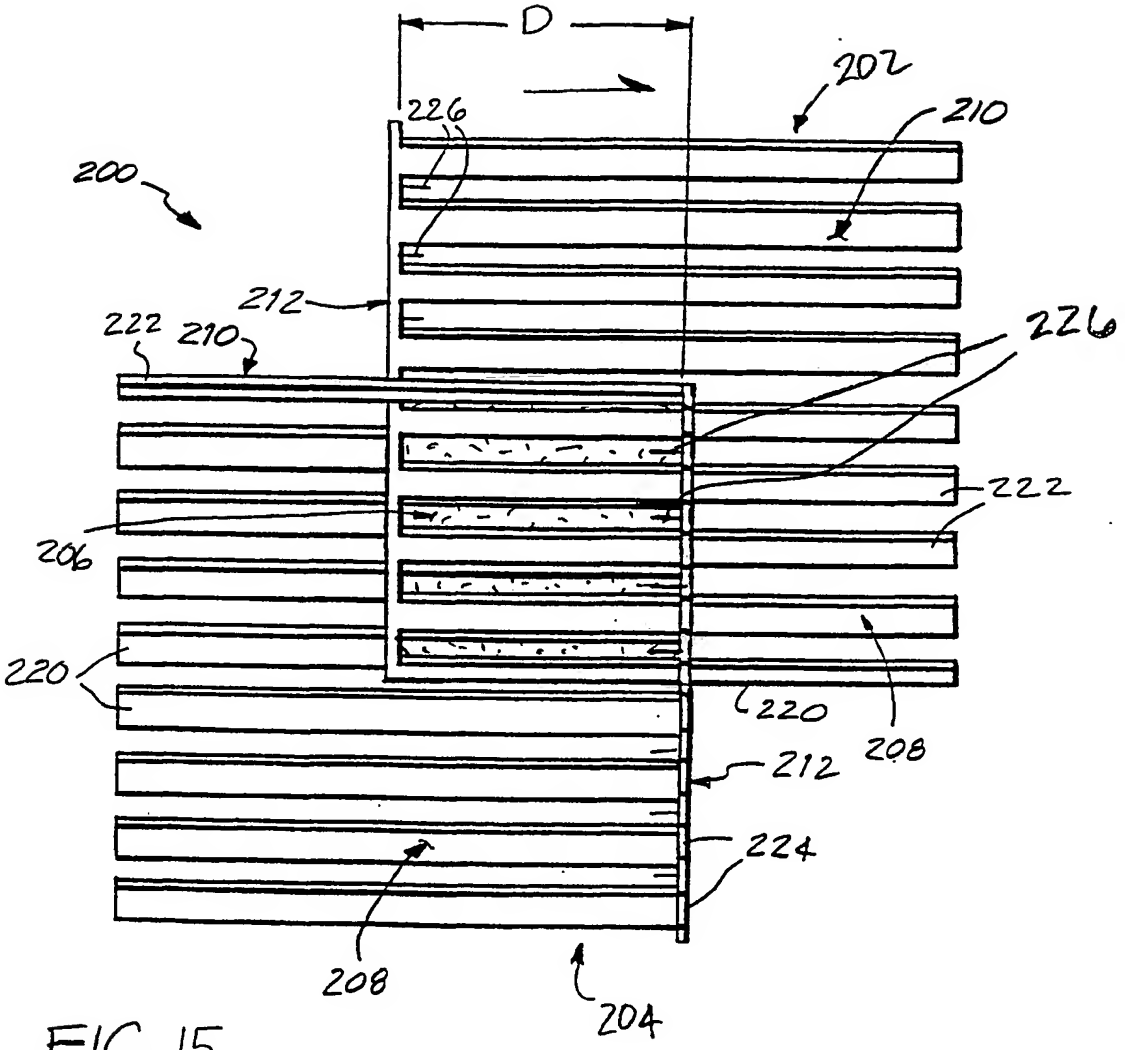
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FIG. 15